C-130J AIRLIFT AIRCRAFT

Air Force ACAT IC Program		**Prime Contractor**
Total Number of Systems:	37	Lockheed Aero
Total Program Cost (TY$):	$4.8B	
Average Unit Cost (TY$):	$73M	
Full-rate production:	N/A	

SYSTEM DESCRIPTION & CONTRIBUTION TO JOINT VISION 2020

The C-130J Hercules II is a medium-range, tactical airlift aircraft designed primarily for the transport of cargo and personnel within a theater of operations. The cargo area can adapt to accommodate a combination of passenger, cargo, and/or aeromedical airlift missions. Variants of the C-130J will perform missions such as psychological operations (EC-130J), weather reconnaissance (WC-130J), and aerial refueling (KC-130J).

The C-130J retains many structural characteristics of the C-130H, having the same overall interior/exterior dimensions. However, the C-130J is more than 70 percent unique, relative to previous models. Significant differences include an advanced integrated digital avionics system, a re-designed flight station intended to facilitate a two-person cockpit, a new propulsion system intended to provide improved take-off, climb and cruise performance, and cargo compartment enhancements.

The C-130J supports the concepts of ***dominant maneuver*** and ***focused logistics*** for ***Joint Vision 2020***.

BACKGROUND INFORMATION

The C-130J aircraft is a contractor-initiated improvement upon the C-130H-3. The United Kingdom, Australia, and Italy have purchased variants of the C-130J design. Creation of a C-130J acquisition program within DOD was directed to provide U.S. Air Force oversight of aircraft development. The C-130J aircraft procurement is proceeding under a commercial acquisition strategy.

Contractor DT&E commenced in spring 1996 and will likely continue through CY03. DT&E has focused on the satisfaction of aircraft requirements defined in the Model Specification. Government Qualification Test and Evaluation (QT&E) has occurred in two formats. Initially, it evaluated designated military utility issues at Edwards AFB in March 1998. Subsequently, a Follow-On Test Program was established by the Air Force to permit evaluation of incremental development progress as well as formation airdrop, the towed-parachute retrieval system, defensive systems, and survivability. These additional tests will be conducted prior to the commencement of the next phase of Qualification Operational Test and Evaluation (QOT&E). QOT&E Phases are called 1A, 1B and 2, and they correlate, with mission software versions 5.1, 5.2, and 5.3 respectively. In August 1999, the Air Force Flight Test Center completed qualification testing of mission computer software version 5.1. This software enables basic airland functions, excluding assault landings and unimproved runway operations. Operational testing with version 5.1 resulted in a limited operational capability release for conversion training only.

DOT&E designated the C-130J aircraft for LFT&E Oversight in May 1995. In March 1998, the Director of OT&E and the Assistant Secretary of the Air Force agreed to a LFT&E program that addresses wing dry bay fire, composite propeller ballistic vulnerability, wing fuel tank hydrodynamic ram effects, engine and engine bay fires, vulnerability to man-portable air defense systems threats, and mission abort vulnerability. The agreement established a joint DOT&E/Air Force C-130J LFT&E program that takes advantage of testing and evaluation under both the DOT&E funded Joint Live Fire (JLF) program for the C-130E/H and the Air Force funded C-130J [LFT&E program] vulnerability reduction program. The JLF program addresses potential vulnerabilities of wing fuel tanks to hydrodynamic ram impact and mission abort vulnerability. A TEMP describing the program was submitted to and approved by DOT&E in July 1999.

DOT&E also designated the U.S. Marine Corps KC-130J aircraft for LFT&E Oversight in January 2000 under the title, C130J (ALL VARIANTS).

The Federal Aviation Administration (FAA) awarded Lockheed Martin a Type Certificate for a commercial version of the C-130J-30 aircraft (a stretch model designated as the 382J, which currently exists only on paper) on September 9, 1998. However, significant C-130J and C-130J-30 military requirements are not included in the FAA certification. This necessitates additional testing by the Air Force and other U.S. government users.

TEST & EVALUATION ACTIVITY

Qualification testing for mission software Version 5.2 was completed in June 2000, and qualification testing for Version 5.3 is tentatively scheduled to start in spring 2001. Operational testing of Version 5.2 began in August 2000 and was completed in September 2000. Operational testing of Version 5.3 is scheduled for spring 2002.

On June 14, 2000, the Program Executive Officer for Airlift and Trainers certified the C-130J as ready to commence Phase 1B (airland) QOT&E with limitations. The AFOTEC Commander reviewed that certification plus the analyses and recommendations of his staff before concurring with the recommendation to start QOT&E. The Director, Operational Test and Evaluation considered total developmental progress as well as AFOTEC's three-phase OT program before approving the recommendations to proceed.

C-130J LFT&E program activities included preparation of detailed reports on the results of the wing dry bay vulnerability testing that was completed in FY99, preliminary planning for the composite propeller ballistic vulnerability testing, and planning and conducting wing fuel tank hydrodynamic ram vulnerability tests. The Air Force is coordinating the propeller Live Fire test activity with the U.S. Marine Corps since a similar propeller design is used on their landing craft-air cushion vehicle. Two C-130H left wing assemblies were subjected to ballistic testing to evaluate hydrodynamic ram damage. The test series consisted of fourteen shots with several different representative threat projectiles into the wing fuel tanks at potentially critical locations. C-130 Aircraft Battle Damage Repair (ABDR) technicians from Robins AFB and an ABDR engineer were on-site during the testing to assess damage and repair the test article for each successive shot.

KC-130J LFT&E program planning was initiated in FY00. The focus of activities was the identification of KC-130J LFT&E issues and the scope of required testing. The intent is to leverage as much information as possible from other C-130J LFT&E tests and analyses and to define a reasonable program that addresses KC-130J's unique design and operational characteristics.

In FY00, DOT&E and the Air Force initiated a C-130 fleet-wide evaluation of potential LFT&E issues. This initiative came as a result of preliminary findings on the results of the dry bay fire tests and recognition that these findings apply to all models of the C-130. The initial planning meeting was held in August 2000 and focused on identification of C-130 fleet LFT&E testing, applicable modeling and simulation, planned modeling and simulation, issues of LFT&E, and plans to address voids in C-130 fleet LFT&E.

TEST & EVALUATION ASSESSMENT

Issues confronting the C-130J program have included logistics support and training systems funding; delayed FAA certification; hardware, software, and technical order deficiencies; manufacturing quality, sub-system reliability, failure to meet required measures of system effectiveness and suitability, lead command responsibilities, resolution of documented deficiencies, schedule credibility, and parallel development of numerous variants to the basic platform.

These issues will continue to affect the program as it progresses through developmental testing and moves toward Phase 2 of operational testing and concurrent delivery of aircraft to selected users undergoing unit conversion training. Operational capabilities will be limited for the foreseeable future.

The overriding shortfall has been in software development and integration. A second critical issue impacting both OT&E and user implementation has been the lack of funding for logistics support and training systems. Future logistics shortfalls will likely render the C-130J "not operationally supportable." Interim contractor support, reparable items, logistics and maintenance data, and maintenance training will all be degraded. These shortfalls will limit operational deployment of the C-130J.

Numerous aircraft deficiencies were discovered during QT&E. Multiple software anomalies within the communication/navigation/identification computer, affecting both logic and integration, impact navigation and preclude automatic (hands-off) airdrop. Lockheed structural limitations have prevented safety certification of paratroop retrieval system hardware. Consequently, the capability to retrieve hung jumpers is uncertain. Lack of a continuous sideslip indicator has also been a problem. These anomalies adversely impact airland and airdrop operations, as well as aircrew workload during mission planning, pre-flight and in-flight operations. Other aircraft restrictions limit cargo loading and unloading.

The ongoing identification of deficiencies, as well as the extent and timeliness of corrective actions, has become a concern during QOT&E. In light of the numerous deficiencies reported by government and contractor test teams, three major upgrade phases involving hardware and software are planned by Lockheed Aero to bring the aircraft into system specification compliance. These upgrades will address more than 50 deficiencies, with precedence given to the most critical deficiencies where possible. The relevance and potential impacts of these deficiencies was assessed throughout Phase 1B of QOT&E and subsequent tests.

The C-130J TEMP was approved by DOT&E on July 29, 1999. Development of a comprehensive test strategy was delayed, in part, by the uncertain program structure and deployment objectives. Operational test programs to examine variant configurations (WC-130J, EC-130J, and KC-130J) and their associated missions are currently under development and review. The KC-130J TEMP is in final draft. The C130J-30 TEMP is in work.

Phase 1B testing ended in September. Based on the results evaluated in Phases 1A and 1B, AFOTEC determined the aircraft not operationally effective for the airland mission. Aircrew workload issues, software discrepancies, cargo loading and cargo constraint requirements were major contributors. The using command is unable to verify manpower requirements to field this system until the crew workload evaluation is complete. That evaluation will not be conducted until airdrop capabilities are delivered in version 5.3, tentatively spring 2002.

In addition, AFOTEC determined the aircraft not suitable. The reliability, maintainability, availability, and logistics supportability demonstrated during Phase 1B were below operational requirements. Deficiencies were noted with on-aircraft integrated diagnostics and fault isolation systems, portable maintenance aids, maintenance technical orders, and availability of spare parts. Additional contractor field service representatives will be required to assist in the maintenance of the aircraft for the foreseeable future.

Based on the results of this testing, the using command will determine the specifics to an interim operational capability release in December 2000.

Preliminary evaluation of C-130J wing dry bay test results indicate that wing dry bay vulnerabilities exist in the C-130J and that fire detection and extinguishing systems using reasonable

masses of pentafluoroethane (HFC-125) or solid propellant gas generator (SPGG) extinguishant could be designed to alleviate these vulnerabilities.

Detailed damage definitions for each wing hydrodynamic ram shot were documented and sent to Lockheed Martin, the C-130J prime contractor, for analysis of post-shot residual strength and remaining flight capabilities. Results of these analyses will be published in FY01.

Realistic, production-representative test articles for C-130J LFT&E wing dry bay fire tests and wing fuel tank hydrodynamic tests were constructed from C-130H aircraft.

CONCLUSIONS, RECOMMENDATIONS AND LESSONS LEARNED

The AFOTEC test team continued to play a significant role in the C-130J program. In accordance with the approved operational test plan, the test team demonstrated that the system is not mature and is neither effective nor suitable to perform airland operations. To ensure operational realism, the operational test plan did not allow the use of maintenance personnel not identified in the maintenance concept of operations. Although contractor Field Service Representatives (FSRs) were available for problem resolution, and the use of FSRs may have expedited the correction of deficiencies and increased the aircraft availability rate, deficiencies with the maintenance manuals, support equipment and integrated diagnostics (i.e., BIT) would not have been highlighted. Until these deficiencies are resolved, the Air Force will require an elevated FSR presence to assist with aircraft maintenance.

Block 5.3 functionality is intended to provide the user with the required combat delivery capability; however, completion of the "spec compliant" software has been repeatedly delayed. Reasons for the delays include an exodus of technical personnel, including software specialists on the Ground Based Data System (logistics) team and management. Also, due to the number of different customers, conflicting priorities have arisen which has shuffled resources throughout the program—resulting in the current delay.

Based on the C-130J LFT&E dry bay fire testing, careful consideration should be given to installing fire detection and extinguishing systems to alleviate identified vulnerabilities.

LFT&E programs can benefit from participation of BDAR personnel who quickly and economically repair test articles for subsequent shots. In addition, the ABDR personnel get exposure to realistic combat damage and training for damage assessment and application of aircraft repair techniques.

I continue to be concerned about the potential vulnerability of this aircraft to fire and explosion from impacts into the wing dry bays and several other large presented areas of the aircraft. We have had extensive discussions with the Air Force and the Under Secretary of Defense (A,T&L) on this issue and we have reached agreement that this is indeed a vulnerability which the Air Force must fix.